Claims

1. A local communication system comprising a ring network conveying source data in both variable rate and fixed rate channels, by means of a regular frame structure, each frame providing a fixed number of source data fields, wherein each field can be reserved dynamically to form part of a fixed-rate channel using the same fields in each frame, and at other times can be allocated to form part of a variable rate channel.

2. A system according to claim 1, wherein blocks for fixed rate data are allocated starting from one end of the frame, while fields for variable rate data are allocated starting at the other end of the frame.

3. A system according to claim 1 ~~or 2,~~ wherein successive frames are grouped into blocks, and each variable rate channel occupies the same fields through all frames of a block, field being reallocated to provide variation of channel width only at the start of each block.

4. A system according to claim 1, ~~2 or 3,~~ wherein a block header is transmitted to reserve a variable rate channel of a specified width for a plurality of successive frames.

5. A system according to Claim 4 ~~claim4,~~ wherein said block header occupies one or more fields of the channel for at least the first frame of the block.

6. A system according to claim 4 ~~or 5,~~ wherein at the start of a block, each channel's block header occupies one or more fields which can be located in the frame with reference to the widths of other channels.

A

7. A system according to ~~any preceding claim;~~ claim 1 wherein each variable rate channel comprises a selection of fields fixed over a predetermined sized block of frames, the width of all such channels being specified in the source data fields of the first frame or frames of each block.

8. A local communication system comprising a ring network conveying source data in both variable rate and fixed rate channels, by means of a regular frame structure in which certain portions of each frame are reserved for said fixed rate channels, whether or not said fixed rate channels are in use, and certain other portions of each frame are available for said variable rate channels, and a control mechanism is provided for allocating said variable rate portion dynamically between different channels.

A

9. A system according to claim 1, ~~2 or 8;~~ wherein the frame rate is synchronised with one or more digital audio data sources, for which source data is carried in the fixed rate portions of each frame.

A-B

10. A system according to claim 1, ~~2, 8 or 9,~~ wherein each frame conveys control bits forming part of a control message frame transmitted over plural frames.

11. A local communication system comprising a synchronous ring network conveying source data in a fixed rate channel over on segment of the ring and while said fixed rate channel is multiplexed with variable rate channels over another segment of the ring.

12. A system according to claim 11, wherein said multiplexed fixed rate channels and variable rate channels comprise different respective portions within a regular frame structure on said other segment of the ring.

13. A fibre optic local communication system, for example according to ~~any of claims 1 to 12~~ Claim 1, suitable for in-vehicle entertainment, communication and/or navigation purposes, having an overall source data capacity greater than 10 Mbps, the fibre optic channel conveying 4B5B or 8B10B encoded data.

14. A system according to ~~any preceding claim,~~ Claim 1, wherein variable data source data channels are mapped on to the network in asynchronous transfer mode packets.

15. A fibre optic local communication system, for example according to ~~any of claims 1 to 12~~ Claim 1, suitable for in-vehicle entertainment, communication and/or navigation purposes, having an overall source data capacity greater than 10Mpbs, the source data comprising variable data rate audio and video data, carried by asynchronous transfer mode (ATM) packets.

16. A system according to claim 15, wherein the headers and data fields of ATM packets do not necessarily consist of 5 bytes and 48 bytes respectively.

17. A local communication system comprising a synchronous ring network, the data rate in a first segment of the ring being higher than that in a second segment of the ring.

18. A system according to claim 17 synchronisation may be maintained for example by the provision of a regular frame structure which has the same frame period in both segments of the network, but a larger quantity of data in each frame of the first segment.

19. A system according to claim 17 ~~or 18,~~ wherein each segment of the ring conveys one or more channels of user information at a relatively high data rate, and one or more channels of control information, the data rate for at least one channel of

control information being constant between the first and second segments, while the data rate for user information is different.

20. A system according to claim 19, wherein the user information flowing in the second segment may be a subset of that flowing in the first segment of the network.

A

Claim 19

21. A system according to ~~any of claim 19 and 20~~, wherein a frame rate is constant in each segment around the network, and within each frame the same number of bits are reserved to form the control message channel in every segment.

22. A local communication system carrying a stream of source data from station to station in a regular frame structure by means of point-to-point links, wherein an error signalling flag is conveyed in each frame in addition to the source data, which flag is set by a station to indicate that an error has been detected in the data of that frame, and is repeated by each station when repeating that data to a next station in the ring.

23. A system according to claim 22, wherein when a source data field of each frame is assigned to various channels having respective source and destination stations around the ring, a single error flag is shared between these channels.

24. A system according to claim 23, wherein each station detecting an error sets the error flag, and wherein the station which sets the error flag resets it when the set flag has returned all the way around the ring, unless a new error is detected.

25. A local communication system wherein a stream of source data is conveyed within a network frame structure, and wherein a flow signalling channel is provided for flow signalling in relation to one or more channels established within the network frame structure.

26. A system according to claim 25, wherein the flow signalling channel is synchronised with the source data at least at the frame level.

27. A system according to claim 25 ~~or 26~~, wherein the flow signalling channel is provided in a separate connection established for the duration of an associated source data connection.

28. A system according to claim 27, wherein the flow signalling connection, once established, can accommodate flow signalling channels for plural associated source data connections.

29. A system as claimed in ~~any of claims 25 to 28~~ Claim 25, wherein the flow signalling channel carries at least one of: (from a source station) validity flags, start-of-packet or other structural flags, (from a destination station) flow control signals.

30. A system as claimed in ~~any of claims 25 to 29~~ Claim 25, wherein the same flow signalling channel carries first flow signalling information from a source station to a destination station, and second flow signalling information from the destination back to the source station.

31. A system as claimed in ~~any of claims 25 to 30,~~ Claim 25 wherein the flow signalling channel is implemented by add-on circuitry and programming outside a synchronous network transceiver integrated circuit.

32. A method of communication wherein source and destination stations interchange data via a ring network, such data being subject to a delay for buffering at one or more intervening stations, the delay depending on the network configuration, the destination station including means for determining said delay and for sending a flow control signal to the source station in advance of a buffer full condition, in accordance with the determined delay.

33. A method of communication wherein source and destination stations interchange data via a ring network, such data being subject to a delay in buffers at one or more intervening stations, and the destination station including means for sending a flow control signal to the source station in the event a buffer full condition,

wherein the source station is arranged upon reception of the flow control signal to repeat data already sent, whereby data already sent but not accepted by the destination is held circulating in the buffers of stations around the network until accepted by the destination station.

A

34. A method as claimed in claim 32 ~~or 33,~~ wherein the flow control signal is also subject to delay, between the destination and the source station.

35. A method for allocating capacity among a plurality of desired connections over a shared network medium, wherein stations of the network communicate to one another their requirements for network capacity, and each station responsible for establishing a respective connection performs a calculation to allocate to that connection a certain capacity, the calculation being performed by all such stations using a common set of rules so as to arrive at a consistent allocation of capacity between the connections.

36. A method as claimed in claim 35, wherein the responsible station for each connection is the source station for that connection.

A

37. A method as claimed in claim 35 ~~or 36~~ wherein connection signalling messages are exchanged in advance of said calculation, such that each responsible station knows the constraints imposed by at least other connections which overlap the given connection.

38. In a local communication system wherein a plurality of stations interchange data via a shared network medium, a method of allocating capacity among a plurality of connections, each connection carrying data from a first station designated as source for that connection to at least one second station designated as destination connection, the method comprising:

(a) generating for each connection a connection signalling message indicating a required capacity for the connection;

(b) receiving the connection signalling messages for the plurality of connections;

(c) determining a suitable allocation of capacity for each connection by a calculation based on the indicated required capacities and an available total capacity;

(d) establishing each desired connection with the determined allocation,

wherein steps (b), (c), and (d) are performed independently at each first station following predetermined rules.

A 39. A method as claimed in claim 37 ~~or 38,~~ wherein the connection signalling messages are generated at least partially by the station designated as source for the connection.

A 40. A method as claimed in claim 37, ~~38 or 39~~, wherein the connection signalling messages are generated at least partially by the station designated as destination for the connection.

41. A method as claimed in claim 40, wherein a connection signalling message is generated by the source station, modified by the destination station, and read by other source stations to obtain the necessary information for the calculation.

42. A method as claimed in claim 41, wherein the network is a ring network comprising a series of point-to-point links, and the modified message is received by the source station and repeated around the ring to ensure that all responsible stations have the necessary information.

A 43. A method as claimed in Claim 35 ~~any of claims 35 to 43,~~ wherein the allocation is re-calculated and varied from time to time.

A 44. A method as claimed in Claim 37 ~~any of claims 37 to 43,~~ wherein the connection signalling messages are exchanged via a dedicated channel established at least for the duration of the associated connections.

 Claim 36

H

45. A method as claimed in ~~any of claims 36 to 44,~~ wherein the network comprises a series of station-to-station links and wherein the rules for allocating capacity to a given connection are defined so as to consider only connections which overlap the given connection.

Claim 36

H

46. A method as claimed in ~~any of claims 36 to 44,~~ wherein the network comprises a series of station-to-station links and wherein the rules for allocating capacity to a given connection are defined so as to consider not only connections which overlap the given connection on one or more of said links but also further connections which overlap those connections without overlapping the given connection.

Claim 37

H

47. A method as claimed in ~~any of claims 37 to 46~~ wherein a first rule is defined so as to ensure a minimum capacity specified in the flow control message at least for each connection of a certain priority, and further rules are specified to distribute remaining capacity among the connections.

48. A method as claimed in claim 47 wherein said further rules take account of a maximum capacity specified in the flow control message for each connection.

Claim 1

H

49. A method as claimed in ~~any preceding claim~~ wherein steps (a) - (d) are repeated periodically to cause adaptive allocation of capacity between connections.

50. A method of communication wherein a plurality of stations interchange data via a ring network in accordance with a plurality of logical connections, each connection carrying data from a first station designated as source for that connection to at least one second station designated as destination for that connection, such data being subject to a delay at one or more intervening stations relative to a frame sequence of the ring network, the method comprising:

(a) defining a succession of rate control periods;

(b) determining in advance of a first rate control period a first channel width for each of the plurality of connections, the first channel width determining a maximum data rate for the corresponding connection;

(c) during said first rate control period establishing a respective channel for each connection in accordance with the determined first channel width; and

(d) during said first rate control period transmitting data for each connection via the respective channel at a rate up to said maximum data rate;

(e) determining in advance of a next rate control period a new channel width for each of the plurality of connections, the new channel width determining a new maximum data rate for the corresponding connection for said next rate control period; and

(f) repeating steps (b) to (e) for said succession of rate control periods,

wherein a rate transition period corresponding to said delay is included at the end of each rate control period and, in the event that the new channel width determined in step (e) is reduced relative to the first channel width, data is transmitted in step (d) only up to said new maximum rate during said rate transition period.

51. A method as claimed in claim 50 wherein data transfer via the network is performed in a regular sequence of frames, each frame having a plurality of data fields for allocation to different said connections, each connection occupying the same data field or fields throughout each rate control period.

52. A method as claimed in claim 51, wherein each rate control period and each transition period correspond to a predetermined number of frames.

53. A method according to ~~any of claims 51 to 52~~ Claim 51, wherein the frame structure further includes a flag field for indicating the transition period.

54. A method according to ~~any of claims 51 to 53~~ Claim 51, wherein the frame structure further includes a flag field for indicating the start of each rate control period.

55. A method of communication between stations in a network, wherein plural variable rate channels are established in a common frame structure, by allocating the same fields of each frame to a given channel throughout a block of frames, adapting the allocation of fields to channels for each successive block of frames.

56. A local communication system comprising a ring network conveying a source data in both variable rate and fixed rate channels, by means of a regular frame structure, each frame providing a fixed number of source data fields, wherein each field can be reserved dynamically to form part of a fixed rate channel which uses the same fields in each frame for the duration of a connection, and at other times can be allocated to form part of a variable rate channel whose width varies during the life time of the relevant connection, and wherein, when a plurality of variable rate channels of non-zero width are established, each frame carries at least some data for every channel.

57. A local communication of system wherein a plurality of stations interchange data via a shared network medium carrying a regular frame structure, each frame providing a fixed number of data fields, and wherein a block of plural frames is established for the allocation of source data fields between a plurality of channels, the allocation being variable between blocks, wherein each successive station wishing to reserve an allocation of capacity places a header in a free field of the first frame in a given block, the header indicating directly or indirectly a next free field in accordance with the number of fields per frame reserved by the source device for its channel, each successive source station around the ring inserting its header to reserve an allocation of fields for the duration of the block at the free field position indicated by said header, such that fields are allocated to channels contiguously within each frame.

58. A local communication system wherein a plurality of stations interchange data via a shared network medium, wherein a regular frame structure, each frame providing a fixed number of data fields, and wherein a block of plural frames is established for the allocation of source data fields between a plurality of connections, wherein each station acting as a source station for a connection reserves an allocated number of

fields in each frame, and wherein each source station is responsible for removing the allocation of fields to a connection whose furthest destination station precedes the source in ring position.

59. A system as claimed in claim 58 wherein each source station maintains a table of the positions of the final destination for each connection.

60. A system as claimed in claim 59, wherein a table of connection ID, source and destination addresses is built from control messages received when the connection is first established, and wherein the connection ID alone accompanies the data in each block.

61. In a local communication system wherein plural stations communicate by the exchange of message frames addressed to one another, such messages competing for capacity in a common channel, a method of communication comprising signalling occupancy of a message reception buffer of at least one particular station, wherein another station wishing to send a message to that particular station will not attempt to do so during occupancy of that station's reception buffer.

62. A method as claimed in claim 61, wherein the buffer occupancy signal is provided in an arbitration field of each message frame.

63. A method as claimed in claim 61 ~~or 62~~ wherein buffer occupancy is signalled by a special station by modifying a predetermined field within messages generated by that station or another station.

64. A communication system wherein an mB/nB code is applied ($m < n$), and wherein data symbols and an escape symbol are defined, and wherein one or more further nB symbols are defined for signalling no data, the no-data symbols being disregarded unless present in a predetermined number of consecutive symbols.

65. A communication system as claimed in claim 64, wherein m = 4 and n = 5, and wherein data or no-data is transmitted on a byte-by-byte basis (byte = eight bits).

Add C'